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ABSTRACT

The effect of background music with lecture tapes, filmstrips, and films in teaching freshman psychology concepts was investigated. Comparisons were made of media effect on visual or non-visual (haptic) and male or female learners, using experiments of 60 students each, with 20 subjects used for all treatment conditions. Three classes viewed filmstrip on human life-stages, accompanied by audiotapes paced with music; a lecture tape on personality, with no music; and a film on mental illness, which included music as part of its sound track. Classes had music either at presentation time, at both presentation and testing time, or only that music present on the commercial products. Background music added to a film or filmstrip did not lower males' or visuals' scores. Haptics and visuals differed in their response to background music with lecture tape, though both improved more when music continued throughout the presentation and the test. Though all media were instructionally efficient, film was superior for women, and film and lecture tape were superior to filmstrip for all subjects. (LMM)

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TEST SCORE RESULTS BY SEX AND PERCEPTUAL TYPE WHEN BACKGROUND MUSIC ACCOMPANIES FILM, FILMSTRIP, AND LECTURE PRESENTATIONS

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TEST SCORE RESULTS BY SEX AND PERCEPTUAL TYPE WHEN BACKGROUND MUSIC ACCOMPANIES FILM, FILMSTRIP, AND LECTURE PRESENTATIONS

Research on the value of music as an aid to learning has not fully answered the questions of when and how to use it. This study will investigate the feasibility of using it as a soft background to lecture, filmstrip and film when teaching certain concepts in freshman psychology. Music's only value may be to pace the action, accompany titles, heighten dramatic effects, change moods and predict things to come in instructional films and filmstrips, but, it is possible that it may actually help to organize information more efficiently in the brains of certain people.

Paivio has proposed dual processing in the brain. Visual, auditory, and affective components are analog; while verbal components are sequential in nature. The parallel processing of holistically perceived stimuli is usually performed in the right hemisphere while sequential processing is in the left hemisphere (Paivio, 1971; 1972). Regelski (1977) believed that music played while verbal material was being presented would cause the two hemispheres to interfere with each other. Later research by Raburn (1981) seemed to substantiate that finding when visual people, as determined by Viktor Lowenfeld's Successive Perception Test-1 (Lowenfeld, 1945) were distracted by background music when they were trying to recognize the exact wording of sentences they had heard before. Non-visual people, called haptics by Lowenfeld, were not affected by music in that experiment, but they scored lower than visuals on the test.

Perception was thought by Lowenfeld to be an innate quality which varied between individuals. He saw a continuum, the ends of which were extremes. At one end were people who were visual and at the other end were people who were non-visual or haptic. In the middle were the indefinites. Visuals use their eyes and learn through visual imagery. Haptics learn by means of touch, feelings, and kinesthetic functions (Lowenfeld & Brittain, 1970). Since haptics respond to sound, and visuals prefer to use their eyes, it seemed appropriate to use them in a study of the effects of music on learning.

An earlier experiment by Raburn (1981) showed that background music was helpful to American Indian teenagers in their understanding of an art film.

Older studies using music as a background while subjects attempted to learn verbal material had proven inconclusive. Fendrick (1937) found that music distracted people who were reading difficult material. Whitely (1934) found that music bothered memorization of verbal material. Others (Henderson, Crews, & Barlow, 1945; Carlson & Hergenhahn, 1967) found that music had no particular effect on learning. Background music helped 8th and 9th grade students make higher scores on a silent reading test in one study (Hall, 1952), but seriously distracted students who were taking a test in another study (Fogelson, 1973). A couple of experiments looked at the effects of music

on arithmetic or mathematics. When background music was used in a fifth grade class where students were performing addition, subtraction, multiplication, and division, it had no effect (Engel & Engel, 1962). Madsen and Forsythe (1973) found that music improved the incidence of correct response to mathematics problems. Mann (1979) found that fourth grade students remembered stories better when they were accompanied by music and sound effects.

Great claims were made for a pedagogical technique called suggestopedia which used music as a background when students were attempting to learn facts. This method originated in Bulgaria and was first introduced to America by Ostrander and Shroeder in 1970, but its ability to increase learning was never documented empirically. It seems to depend more on hypnosis than on music for its effect, if any.

Music as a background to other media might qualify as multimedia, but if that medium also contained music to heighten the effects of a verbal presentation, an added background of music might act as noise. Noise is thought to be a form of psychological stress, and Jerison (1959) found it bad for sustained performance, but of no particular effect in short performances.

It was hypothesized that background music when added to a commercial film or filmstrip composed of visual and verbal

elements and paced by occasional music will:

(1) lower the scores of a greater number of males than it will females.

(2) lower the scores of visual individuals significantly.

(3) raise the scores of non-visual (haptic) individuals significantly.

It is also hypothesized that the same background music when added to a lecture presentation will:

(1) lower the scores of more males than females.

(2) lower the scores of visual individuals significantly.

(3) not affect the scores of non-visual (haptic) individuals in a significant way.

These hypotheses are based on the widely held assumption that males are more visual than females. They are also based on previous research (Raburn, 1981) which showed that visual individuals were distracted by music in a sentence recognition task.

It is further hypothesized that when music is present at both presentation time and at testing time, scores of both visual persons and haptic persons will be lowered slightly, but not significantly so.

METHOD

At a university where General Psychology is one of the options to meet part of the general education requirements, three freshman psychology classes were chosen. They all met in the morning, in the same room, and were taught by the same teacher, a Ph.D. with 10 years of experience. Since it was impossible to randomly assign students to the treatment groups, a pretest was given on the information to be taught to them by one of three methods: film, filmstrip, or lecture tape. This pretest was given on a Wednesday before the instruction was given on the following Friday. It was the same test that would be given to them after presentation of the material to be learned. Each of the classes was given information through the same film, filmstrip, and lecture tape. One class had music at presentation time, one had music at both presentation and testing time, an one was a control group which had no music at all except what was present on the commercial products. The classes were rotated on each change of media so that each class was subjected to each type of treatment, and each class was a control group at one time during the experiment. It was felt that rotation of the treatments and the giving of pretests would offset to some degree the lack of random assignment of

subjects to treatment groups. Subjects were pulled randomly out of the classes for the statistical tests, and the same twenty people were used as subjects for all of the treatment conditions. That is, ten males and ten females were chosen and the scores of those people from each class were used as the scores to compare all of the media. Another ten visuals and ten non-visuals or haptics were randomly chosen from each class, and those people were used to compare all of the media and its effect on visuals and haptics. Each experiment used 60 people, and each person had 3 scores, one from each treatment condition which ranged over the three media of instruction. Since the classes varied in size from thirty to forty people, there was some overlap in the two groups, male/female and visual/haptic. Some subjects chosen for the male/female experiment were also chosen for the visual/haptic experiment.

All media were approximately the same length (25 minutes) and the multiple-choice test was given immediately after presentation of the information by each medium. The first week of the experiment all classes had a filmstrip which dealt with the stages of human life: Adolescence to Old Age. Part six, Young Adulthood, and part 7, The Mature Adult were shown. These filmstrips were accompanied by audiotapes which were paced by music. One month later all classes had a lecture tape on personality which had been done by the psychology professor, and which

had no music as background or pacing. At the end of another four weeks, all of the classes were shown a film on mental illness which included music as part of its sound track. The name of the film was, "Abnormal Behavior in a Mental Hospital." No one was permitted to take notes. Studies on the effectiveness of note taking do not agree. For example, Weiland and Kingsbury (1979) showed that the act of taking notes improves both immediate and delayed recall. Ash and Carlton (1953) found that note taking interferred with learning when film was the medium of instruction.

Pretest scores were subtracted from posttest scores and the difference scores were used in a multivariate analysis. (See Table 1 for design.) Since these difference scores can sometimes be unreliable, an analysis of covariance was also done on each medium so that the pretest scores were the covariates and could be used to adjust for possible initial differences in knowledge among the treatment groups. T-tests were done on pretest and posttest scores in each medium to see if they were significantly different from each other, and a one-way analysis of variance was done between all three of the classes to see if they showed

DESIGN

Multivariate Analysis

	Lecture Class 1	Lecture Class 2	Lecture Class 3
	Treatment 2 *	Treatment 3 *	Treatment 1 *
Male	10	10	10
Fem-ale	10	10	10
	Film Class 1	Film Class 2	Film Class 3
	Treatment 3 *	Treatment 1 *	Treatment 2 *
Male	10	10	10
Female	10	10	10
	Filmstrip Class 1	Filmstrip Class 2	Filmstrip Class 3
	Treatment 1 *	Treatment 2 *	Treatment 3 *
Male	10	10	10
Female	10	10	10

Table 1

The same design was used for the visual/haptic analysis.

Substitute visual for male and haptic for female in this design.

*Treatment 1 = Music at Presentation Time
*Treatment 2 = Music at Presentation Time and at Testing Time
*Treatment 3 = No Music

differences. To make the classes equal for these one-way analyses, students were drawn randomly from the larger classes until equality was achieved. Twenty-seven people was the smallest number used when testing the three classes for differences.

Random selection of 10 males and 10 females were taken from each class to serve as subjects when testing the hypothesis of no difference in the effect of music by sex. Random selection of 10 visuals and 10 haptics as determined by Lowenfeld's SPT-1 test were chosen to serve as subjects when testing the hypothesis of no difference in the effect of music by perceptual type. Those who scored in the upper 5% and the lower 5% of the scores made were considered to be visuals and non-visuals (haptics) respectively. Missing data caused a reduction in the number of subjects used to fall from 60 to 54. Equal cells were needed for the multivariate analysis, so one person was removed randomly from each cell. This was not considered to be a serious reduction since 9 per cell gives a minimum power of .96 to detect differences of two or more standard deviations.

Music was chosen by a music professor and was recorded on tape. It was a string quartet; 2 violins, a viola, and a violoncello; chosen for its calm, unobtrusive, and major key qualities. It was a selection that is not widely known, "The Middle Quartets" by Beethovan, and it was recorded carefully

onto a tape so that loud portions could be softened to an overall blandness. Only one movement, Molto Adagio, was used, and this was repeated over and over for thirty minutes.

RESULTS

Means and standard deviations of pretest scores did not show any differences between the three classes. A one-way analysis of variance of the classes using each of the three media of instruction showed no significant difference in either the raw posttest scores or in improvement (difference) scores. See Tables 1 and 2.

PRETEST SCORES			
		Filmstrip	
CLASS	MEAN	S.D.	CORRELATION
1	14.57	3.48	.495
2	14.16	3.38	.735
3	14.46	3.06	.61
		Lecture Tape	
CLASS	MEAN	S.D.	CORRELATION
1	10.54	3.50	.71
2	11.37	3.92	.52
3	10.58	3.84	.492
		Film	
CLASS	MEAN	S.D.	CORRELATION
1	9.41	2.42	.573
2	9.97	2.93	.420
3	10.13	2.70	.484

Table 1

COMPARISON OF THE SCORES OF THE THREE PSYCHOLOGY CLASSES					
		Filmstrip			
	SS		df	MS	F
Raw Scores	32.16		2	16.03	.59
Difference scores	11.553		2	5.776	.820
		Lecture tape			
	SS		df	MS	F
Raw Scores	19.00		2	9.5	.337
Difference scores	58.789		2	29.394	1.75
		Film			
Raw Scores	8.98		2	4.49	.398
Difference scores	10.64		2	5.32	.528

Table 2

Results of these tests indicate that the assignment of students to the three classes is as if it were random, since the classes seem to be similar with respect to pretest scores, posttest scores, and improvement scores. Also, since correlations between pretest and posttest scores were not particularly high, difference scores can be considered reliable.

Results of the multivariate analysis using difference scores by sex showed no melody effects on film, filmstrip or lecture tape. There was no interaction, and no sex effect except when film was the medium of instruction. The F-test for sex in the film analysis was $F_{1,48} = 4.03$, $p < .0505$. Pairwise comparisons

controlled for error by Tukey's HSD method showed no significant difference in any one melody condition, but the overall difference was highly significant, t (52) = 4.19, $p < .002$. (See Figure 1 plot of means of males and females in the three treatment conditions for film.)

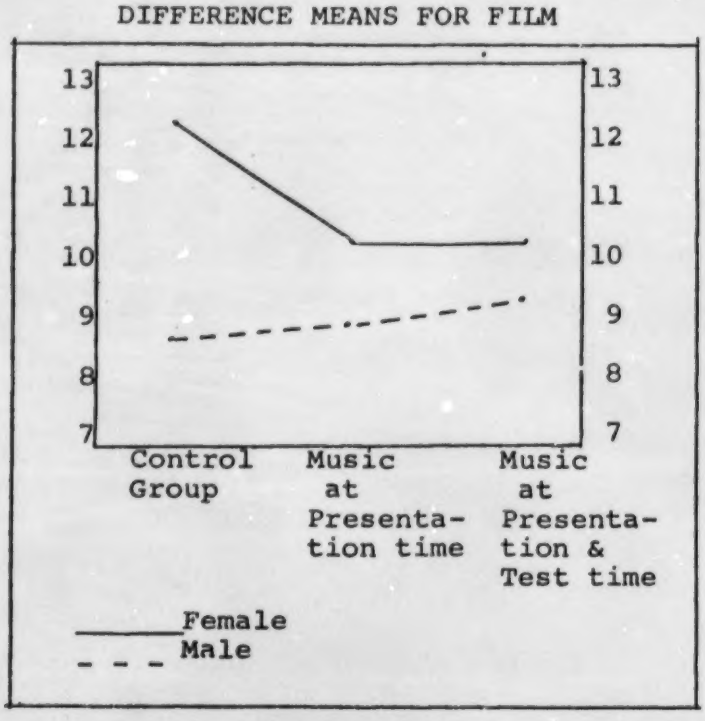

Figure 1

Since the improvement of females was so much higher than that of males in the control group, pretest scores were compared for the two groups. Means of the pretest scores were almost exactly the same for males and females, varying from each other by only 0.8.

An analysis of covariance was performed on raw scores of the posttest, using pretest scores as the covariate. Results showed stronger evidence of a difference between males and females when the medium of instruction is film, $F_{1,48} = 7.75$, $p < .01$. (See Table 3.)

FILM SUMMARY TABLE

(Comparing difference scores and posttest scores with pretest scores covaried out.)

SOURCE	SS	df	MS	F
Sex difference scores	37.50	1	37.50	4.03
Posttest adjusted by pretest scores (sex)	61.20	1	61.20	7.75
Melody difference scores	5.77	2	2.88	.31
Posttest adjusted by pretest scores (melo)	22.47	2	11.235	1.42
Sex * Melody	12.44	2	6.22	.67
Error	447.111	48	9.3148	
Corrected total	502.83	53		
Adjusted error	379.41	48	7.90	

Table 3

The overall Wilkes Lambda Criterion was not significant, yielding $F_{6,92} = .35$, $p < .90$ for the interaction; $F_{3,46} = 1.76$, $p < .167$ for sex effect; and $F_{6,92} = .75$, $p < .61$.

Results of the multivariate analysis using difference scores by perceptual type showed no melody effects using the film and filmstrip, but did show melody effects when a lecture tape was the medium of instruction, $F_{2,48} = 4.54$, $p < .01$.

There were no significant differences between visuals and haptics, but when the lecture tape was the medium of instruction the difference scores of haptics and visuals approached a significant difference, $F_{1,48} = 3.51$, $p < .06$. There was no interaction.

An analysis of covariance performed on posttest scores, adjusting for the pretest results gave a weaker, but still significant melody effect, $F_{2,48} = 3.20$, $p < .05$, and a significant difference between visual and haptic subjects, $F_{1,48} = 7.55$, $p < .01$. See Table 4.

LECTURE TAPE SUMMARY TABLE

(Comparing difference scores and posttest scores with pretest scores covaried out.)

Source	SS	df	MS	F
Perceptual Type difference scores	71.185	1	71.185	3.51
Posttest adjusted by pretest scores (Perc)	192	1	192	7.55
Melody difference scores	184.037	2	92.01	4.54
Posttest adjusted by pretest scores (Melo)	162.703	2	81.35	3.20
Perceptual Type * Melo	42.70	2	21.35	1.05
Error	973.777	48	20.287	
Corrected Total	1271.7037	53		
Adjusted error	1221.533	48	25.44	

Table 4

Pairwise comparisons showed visuals did significantly better than haptics in the melody at presentation time condition, t (51) = 2.74, $p < .01$. Music caused haptics to do worse and visuals to do better. Visuals improved when music was present and haptics did not. See Figure 2 for Plot of the Means.

DIFFERENCE MEANS FOR LECTURE TAPE

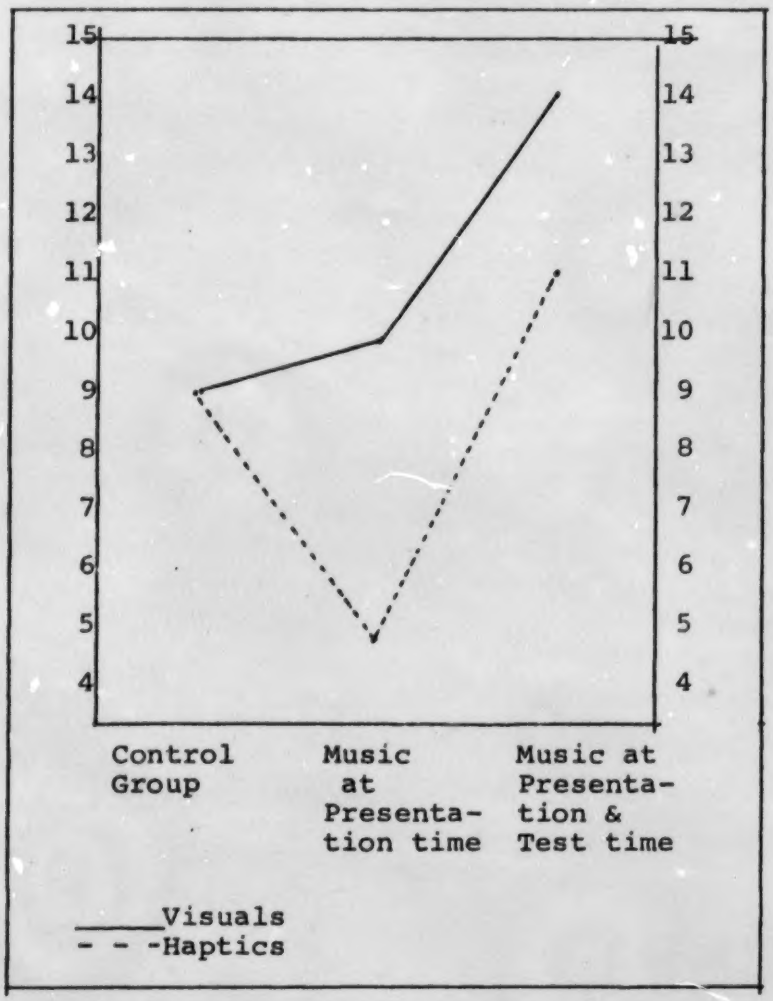

Figure 2

The Wilkes Lambda Criterion showed an overall melody effect, $F_{6,92} = 2.30$, $p < .04$. The Hotelling-Lawley Trace was also significant for melody effect, $F_{6,90} = 2.42$, $p < .03$.

Posttest scores were much improved over pretest scores in all media. Correlated t-tests between pretest and posttest scores of the film, filmstrip, and lecture tape sessions showed a significant rise in posttest scores with each medium of instruction. The differences observed between the two sets of scores in each medium could not have occurred by chance but once in a thousand times. Although every correlated t-test was significant to .001, that does not necessarily mean that learning took place. Stake (1971) has pointed out that gain scores can appear to reflect learning that does not occur. In this case, however, correlations between pretest and posttest scores were only moderate so that more confidence can be placed in the reliability of the difference scores.

Because of the sex effect which showed film to be better for females than for males, additional tests were done on the media of instruction. All filmstrip scores, film scores, and lecture tape scores made by females, and those made by males, were put gether regardless of treatment condition. Results of the analysis of variance showed sex to be a significant factor, $F_{1,180} = 4.61$, $p < .03$. Media was also significant, $F_{2,180} = 19.171$, $p < .001$. Pairwise comparisons between means showed the lecture tape much better than the filmstrip for men, t (60)

= 4.65, $p < .001$. The lecture tape was also better than the filmstrip for females, t (60) = 2.02, $p < .05$, and the film was also better than the filmstrip for females, t (60) = 2.80, $p < .05$. Although the improvement means for men and women were not significantly different in any one medium, the difference in the effectiveness of that media by sex was different. Film and lecture tape were better than the filmstrip for both men and women, but film was best for women and the lecture tape for men.

Another two by three ANOVA was done using visuals and haptics to compare film to lecture tape to filmstrip. Again, the lecture tape and film proved superior to the filmstrip. Media was significant, $F_{2,66} = 9.15$, $p < .001$. Perceptual type was not significant.

DISCUSSION

The hypotheses were not supported. Background music when added to a film and filmstrip did not lower the scores of males or of visuals significantly. There was no effect when bland background music was played along with a film or a filmstrip. There was no effect when the same music was played while the subjects took a test on the content of the film or filmstrip.

The same background music when added to a lecture presentation on tape, lowered scores of females more than it did males, but this drop was less than a two point difference in the mean

of the females who had music and the mean of the control group females. It was not significant.

Music did not lower the scores of visual individuals. It raised them. Apparently the task of recognizing the exact wording of a sentence is quite different from getting the sense out of an auditory verbal presentation. Music may distract visuals in an exacting task such as word recognition, but they were helped by the addition of music to the lecture tape. Both visuals and non-visuals improved more when music was continued throughout the whole presentation and the test. This study did not agree with the Fogelson study which found music distracting to students who were taking a test. Many variables are at work when music is added to a medium of instruction. The type of music is a factor, and so are individual differences in students. The same music may affect different people in different ways. It is possible that some people would find some music distracting on a test. The string quartet used in this study was not distracting to any group which was taking a test. It seemed to facilitate the making of high scores for visuals and haptics on a test given after instruction by a lecture tape accompanied by background music.

CONCLUSIONS

It would be unwise to draw definite conclusions from such a small sample of people who were not randomly assigned to the treatment groups. Since they did seem to be evenly matched

according to comparisons of gain scores and pretest scores, it is appropriate to tentatively say that music can be a good addition to visual and/or verbal presentations. Background music in addition to music already present on a film or a filmstrip is superfluous. When no music accompanied the auditory verbal presentation on tape, males and females did just as well or slightly better than they did when music was added, but the addition of background music seemed to help visual students learn the information. It caused haptic scores to drop unless music continued through the testing time. This is somewhat puzzling. It may mean that haptics adjust to the music and begin to ignore it, but their scores surpass those of haptics in the control group, suggesting that music may help them to remember information that had accompanied the music earlier. Haptics and visuals are different from each other in their response to music as background to a lecture tape. Visuals outperform haptics except in the control group. Music may serve to mask other noises, and to focus attention on the medium of instruction. It may serve as an auditory image which provides additional information to the brain just as Paivio's visual images seemed to do (Paivio, 1972).

The sex effect showing film to be a better medium of instruction for women than it was for men, was a surprise. This experiment was not set up to compare the media of instruction to each other, but the tests that were done to check this

effect suggest that film and lecture tape are superior to filmstrip for both men and women and for both visuals and haptics. It is possible that this filmstrip was not as good as the film and the lecture tape in quality, or in the presentation of content. Research that matches quality and content of these three media should be done to see if this difference in effectiveness is a true one. All of the media of instruction were efficient in their ability to teach facts to these students so that they could make acceptable scores on a multiple choice test after exposure to the media.

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